Magnetic field within magnetosheath jets during northward and southward interplanetary magnetic field conditions

Laura Vuorinen\textsuperscript{1}, Heli Hietala\textsuperscript{1,2}, and Ferdinand Plaschke\textsuperscript{3}
\textsuperscript{1}Department of Physics and Astronomy, University of Turku, Turku, Finland (lakavu@utu.fi)
\textsuperscript{2}The Blackett Laboratory, Department of Physics, Imperial College London, London, UK
\textsuperscript{3}Space Research Institute, Austrian Academy of Sciences, Graz, Austria

Downstream of the Earth’s quasi-parallel shock, transients with higher earthward velocities than the surrounding magnetosheath plasma are often observed. These transients have been named magnetosheath jets. Due to their high dynamic pressure, jets can cause multiple types of effects when colliding into the magnetopause. Recently, jets have been linked to triggering magnetopause reconnection in case studies by Hietala et al. (2018) and Nykyri et al. (2019). Jets have been proposed to affect magnetopause reconnection in multiple ways. Jets can compress the magnetopause and make it thin enough for reconnection to occur. Jets could also affect the magnetic shear either by indenting the magnetopause or via the magnetic field of the jets themselves. Here we want to study whether the magnetic field of jets can statistically affect magnetopause reconnection. In particular, we are interested in whether jets could enhance reconnection during more quiet northward IMF conditions.

We statistically study the magnetic field within jets in the subsolar magnetosheath using measurements from the five Time History of Events and Macroscale Interactions during Substorms (THEMIS) spacecraft and OMNI solar wind data from 2008–2011. We investigate jets next to the magnetopause and find that the magnetic field within jets is statistically different compared to the non-jet magnetosheath. Our results suggest that during southward IMF, the non-jet magnetosheath magnetic field itself has more variation than the jets. This suggests that jets should have no statistical, neither enhancing nor suppressing, effect on reconnection during southward IMF. However, during northward IMF, the magnetic field within jets is statistically favorable for enhancing magnetic reconnection at the subsolar magnetopause as around 70 % of these jets exhibit southward fields close to the magnetopause.